BIOE 537: Genetic and Epigenetic Control

Isaac Hilton, PhD

Spring 2019; MWF 10 – 10:50; BRC 285

Catalog Description: All human diseases are driven by alterations in genetic sequences, cellular transcription, and/or chromatin structure. In this course students will learn how transformative new technologies permit measuring and engineering these alterations, and how bioengineers can leverage these innovative tools to combat human diseases and catalyze advances in biotechnology.

Course Objectives and Learning Outcomes: Students should learn the fundamentals of genetics, epigenetics, and molecular biology from the perspective of a modern bioengineer. Students should also improve their presentation skills, critical thinking, and ability to evaluate scientific literature.

Instructor: Isaac Hilton, PhD. BRC 669. isaac.hilton@rice.edu

Textbook: No textbook is required. We will learn from primary scientific articles and reviews.

Grading:

Attendance: 15%

Class Participation: 25%

Oral Presentation: 25%

Group Grant Presentation: 35%

Attendance: Students are permitted 2 absences. Further absences will negatively impact course grade. Extenuating circumstances will be considered on a limited basis.

Class Participation: Active engagement and asking/answering questions is expected of all students. These qualities are displayed by all competent scientists and engineers. Unprofessional behavior and inattention is not appropriate. Use of cell phones, social media, etc. is prohibited during lecture.

Oral Presentation: Students will give a ~20 minute powerpoint (or similar) presentation covering a primary research article selected from a list provided by the instructor. Students must select their presentation date within the first week of the course, otherwise course grade will be negatively impacted. Presentations will be graded by the instructor and peers.

Group Grant Presentation: Students will divide into four groups and at the end of the semester each group will give a ~20 minute powerpoint (or similar) presentation covering their idea for an NIH R01 proposal relevant to the course material. Presentations will be graded by peers and the instructor. Grading will be based upon creativity and feasibility, as well as NIH scoring metrics including significance, innovation, and approach.

Honor Code: You are expected to strictly adhere to Rice's Honor Code.

Disabilities: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with the instructor and Disability Resource Center during the first two weeks of class. Discussions will remain as confidential as possible.

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	Week	Lecture	Date	Topic	Student Presenters
Module 1: Fundamentals	1	1	Mon; 1/7/2019	Course and Syllabus overview	
		2	Wed; 1/9/2019	Genetic Variation and the Human Genome	
			Fri; 1/11/2019	*NO CLASS*	
	2	3	Mon; 1/14/2019	Transcription of Coding Regions in Human Cells	
		4	Wed; 1/16/2019	Transcription of Noncoding Regions in Human Cells	
			Fri; 1/18/2019	Student Presentations - Section 1	Razi and Lucas
	3		Mon; 1/21/2019	*NO CLASS - Martin Luther King Jr. Day*	
		5	Wed; 1/23/2019	Translation of Human Proteins	
			Fri; 1/25/2019	Student Presentations - Section 2	Rosa and Andrei
	4	6	Mon; 1/28/2019	Epigenetics: DNA Methylation in Human Cells	
		7	Wed; 1/30/2019	Epigenetics: Histone Modifications in Human Cells	
			Fri; 2/1/2019	Student Presentations - Section 3	Jing Qi and Kai
	5	8	Mon; 2/4/2019	Human Chromatin Structure and the 4D Nucleome	
		9	Wed; 2/6/2019	Transcription Factors, Chromatin Remodelers, and Pioneer Factors	
			Fri; 2/8/2019	*NO CLASS - Spring recess*	
Module 2: Technology	6	10	Mon; 2/11/2019	Genomics and Sequencing Technologies	
		11	Wed; 2/13/2019	Assaying the Human Transcriptome	
			Fri; 2/15/2019	Student Presentations - Section 4	Shubham and Andrew
	7	12	Mon; 2/18/2019	Assaying Epigenomic Dynamics	
		13	Wed; 2/20/2019	Assaying Chromosome Conformation	
			Fri; 2/22/2019	Student Presentations - Section 5	Siavash and Shyam
	8	14	Mon; 2/25/2019	Engineering Sequencing Information in Human Cells	
		15	Wed; 2/27/2019	Manipulating the Human Transcriptome	
			Fri; 3/1/2019	Student Presentations - Section 6	Kshitij and Lauren
	9	16	Mon; 3/4/2019	Engineering Epigenetic Signatures in Human Cells	
		17	Wed; 3/6/2019	Engingeering Human Chromatin Structure	
			Fri; 3/8/2019	Student Presentations - Section 7	Biki and Ronan
	10		Mon; 3/11/2019	*NO CLASS - Rice **Undergrad** Spring break*	
			Wed; 3/13/2019	*NO CLASS - Rice **Undergrad** Spring break*	
			Fri; 3/15/2019	*NO CLASS - Rice **Undergrad** Spring break*	
Module 2: Applications	11	18	Mon; 3/18/2019	Building and Delivering Synthetic DNA/RNA/Proteins	
		19	Wed; 3/20/2019	Synthetic Genomes and Cells	
			Fri; 3/22/2019	Student Presentations - Section 8	Peter and Steven
	12	20	Mon; 3/25/2019	Disease Modeling and Clinical Applications	
		21	Wed; 3/27/2019	Guest Lecture: **Andrew DiNardo; MD**; BCM Physician/Scientist	
			Fri; 3/29/2019	Student Presentations - Section 9	Work on Grant Ideas
	13	22	Mon; 4/1/2019	Guest Lecture: **Robert Sons, PhD;** Fannin Entrepreneurship Fellow	
		23	Wed; 4/3/2019	Guest Lecture: **Courtney Hodges, PhD**; BCM Cancer Biologist	
			Fri; 4/5/2019	Student Presentations - Section 10	Work on Grant Ideas
	14		Mon; 4/8/2019	Grant Idea Presentations - Groups 1 and 2	
			Wed; 4/10/2019	Grant Idea Presentations - Groups 3 and 4	
		24	Fri; 4/12/2019	Class discussion - our visions for the future	
	15		Mon; 4/15/2019	Backup date if needed; otherwise NO CLASS	
			Wed; 4/17/2019	Backup date if needed; otherwise NO CLASS	
			Fri; 4/19/2019	Backup date if needed; otherwise NO CLASS	

Schedule subject to change